
Novonanmek

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NOVONANMEK MATERIAL SCIENCES PRIVATE LIMITED

Creating Reference Architectures for Critical Infrastructure

Novonanmek Material Sciences Private Limited is an architecture, standards and infrastructure assurance organization focused on the development of **system-level architectural frameworks for emerging critical infrastructure**.

Novonanmek's work is based on a simple premise:

Infrastructure systems are larger than individual projects.

Large-scale infrastructure is developed through multiple projects, organizations and investments over long periods. Without a common system-level architectural reference, independently developed projects can create fragmentation, incompatible interfaces, duplication, constrained expansion and other system-level risks.

Novonanmek develops **Benchmark System Architectures** to provide a common architectural reference against which infrastructure can be developed, compared, assessed and maintained throughout its lifecycle.

Benchmark System Architectures

Novonanmek is the **originator, owner and official steward** of two architectural standards:

HOPT-AS: Hub-Only Pipeline Topology Architecture Standard

HOPT-AS establishes a system-level architectural framework for CCUS infrastructure based on the Hub-Only Pipeline Topology. It defines architectural principles, system boundaries, topology, stakeholder relationships, Architecture Classes and requirements for maintaining architectural integrity.

HLAS: Hydrogen Logistics Architecture Standard

HLAS establishes a system-level architectural framework for hydrogen logistics infrastructure. It is intended to support interoperable, scalable and resilient hydrogen logistics infrastructure across jurisdictions and markets.

Both standards are designed to provide an architectural reference rather than prescribe the detailed engineering design of every individual project.

Why System-Level Architecture Matters

A major infrastructure system is rarely developed by one organization.

Government may establish the overall infrastructure strategy. Developers may develop individual projects. Engineering organizations design and construct facilities. Infrastructure owners and operators manage assets. Investors and lenders commit capital. Insurers assess exposure. New projects subsequently connect to and modify the existing system.

Each participant may make a rational decision for its own project. The resulting system, however, may not necessarily be coherent.

A system-level architecture provides a framework for considering:

- How different infrastructure components relate to one another;
- System boundaries;
- Topology;
- Interfaces;
- Stakeholder responsibilities;
- Scalability;
- Interoperability;
- Resilience; and
- Long-term evolution.

The Benchmark System Architecture provides the additional ability to ask:

How does a particular infrastructure proposal compare with the established architectural reference?

This creates a common basis for architectural discussion across otherwise independent projects and organizations.

From Benchmark to Infrastructure Decision

Novonanmek's role extends beyond publication of the standards.

The Benchmark System Architectures can be applied at different points in an infrastructure project's lifecycle.

1. Benchmark-Led Consultation

A developer, infrastructure owner or government may begin with the Benchmark System Architecture. Novonanmek can assist in understanding and applying the benchmark while the project architecture is being developed.

Objective: establish the project architecture with the benchmark as a reference from the outset.

2. Benchmark Gap Consultation

A project may already have a blueprint or proposed architecture without having previously used HOPT-AS or HLAS. At this stage, Novonanmek can assess the proposed architecture against the benchmark and identify architectural gaps and deviations.

Because the project is still capable of modification, the findings can be used to improve the architecture before major financial or contractual commitments are made.

Objective: identify and address architectural gaps while changes remain possible.

3. Benchmark Assessment / Scoring

A lender, investor, insurer, government or other decision-maker may receive a project for consideration that has been developed independently of the benchmark.

The project can then be independently assessed against the applicable Benchmark System Architecture. The assessment provides a structured view of the project's architectural position and its material deviations from the benchmark, according to the applicable assessment methodology.

Objective: provide independent architectural evidence for financing, investment or other major infrastructure decisions.

4. Dynamic Compliance

Following commitment, the question changes

The issue is no longer simply:

“How does the proposed project compare with the benchmark?”

It becomes:

“Is the project continuing in accordance with the architectural position that was assessed and committed?”

Dynamic Compliance provides a continuing mechanism for assessing architecturally significant changes as infrastructure is developed, constructed, operated, expanded or modified.

Its purpose is to preserve the defining characteristics of the applicable Architecture Class and prevent **Architectural Drift**.

Who Uses the Novonanmek Framework?

Novonanmek's Benchmark System Architectures are relevant to a broad infrastructure ecosystem.

Governments and Public Authorities

Governments can use the frameworks as references for national and regional infrastructure planning, infrastructure programs and evaluation of proposed infrastructure configurations.

Infrastructure Developers

Developers can use the benchmarks when creating new projects or assessing an existing project architecture before financing and implementation.

Infrastructure Owners and Operators

Owners and operators can use the framework to maintain architectural integrity as infrastructure evolves.

Engineering and EPC Organizations

Engineering organizations can use the architectural framework as a system-level reference while developing detailed project designs.

Investors and Infrastructure Funds

Investors can use benchmark assessment as an additional system-level input to infrastructure investment analysis.

Banks and Lenders

Lenders can obtain an independent assessment of the architecture underlying a proposed financing decision and, following commitment, use Dynamic Compliance as an ongoing architectural assurance mechanism.

Insurers

Insurers can use the benchmark as an additional reference for understanding system-level architectural characteristics and associated infrastructure exposure.

Portfolio Owners and Infrastructure Authorities

Organizations managing multiple infrastructure assets can use a common architectural reference across projects and systems.

Novonanmek's Position

Novonanmek does not seek to prescribe one physical design for every infrastructure project. Its role is to establish and steward a **common architectural reference**.

The company maintains the authoritative versions of HOPT-AS and HLAS, establishes and maintains their architectural principles and Architecture Classes, provides official interpretations and administers the associated architectural assurance and Dynamic Compliance frameworks. The standards therefore create a distinction between:

The Benchmark

The architectural reference

The Project

The infrastructure architecture being developed or assessed

The Assessment

The independent determination of the project's position relative to the benchmark

Dynamic Compliance

The continuing preservation of the assessed architectural characteristics after commitment

The Novonanmek Value Proposition

Novonanmek's proposition can be summarized in four stages:

DEVELOP: Use the Benchmark System Architecture as the reference for developing infrastructure.

IMPROVE: Identify architectural gaps and make changes while the project is still capable of being modified.

ASSESS: Provide an independent architectural assessment before major financing or infrastructure commitment.

ASSURE: Maintain architectural integrity through Dynamic Compliance as the infrastructure evolves.

In simple terms:

- **Develop against the benchmark.**
- **Improve before commitment.**
- **Assess before financing.**
- **Preserve after commitment.**

Looking Ahead

As CCUS, hydrogen and other forms of critical infrastructure develop across multiple jurisdictions and involve increasingly interconnected networks of projects and participants, the ability to consider infrastructure at the **system-architecture level** becomes increasingly important.

Novonanmek's objective is to provide the architectural frameworks and assurance mechanisms that allow stakeholders to make these systems more coherent, comparable and capable of long-term evolution.

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Originator, Owner and Official Steward of HOPT-AS and HLAS

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